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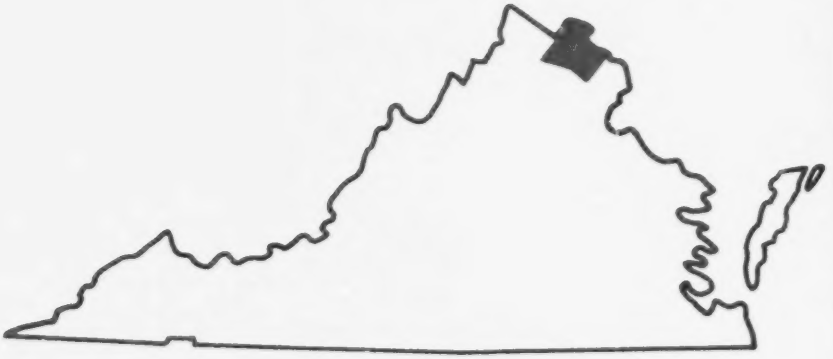
# FLOOD INSURANCE STUDY

## TOWN OF PURCELLVILLE, VIRGINIA
## LOUDOUN COUNTY



NOVEMBER 15, 1989

Federal Emergency Management Agency

COMMUNITY NUMBER - 510231

NOTICE TO
FLOOD INSURANCE STUDY USERS

Communities participating in the National Flood Insurance Program (NFIP) have established repositories of flood hazard data for floodplain management and flood insurance purposes. This Flood Insurance Study (FIS) may not contain all data available within the repository. It is advisable to contact the community repository for any additional data.

Part or all of this FIS may be revised and republished at any time. In addition, part of this FIS may be revised by the Letter of Map Revision (LOMR) process, which does not involve republication or redistribution of the FIS. It is, therefore, the responsibility of the user to consult with community officials and to check the community repository to obtain the most current FIS components.

Initial Flood Insurance Study Effective Date: November 15, 1989

Flood Insurance Study Revised:

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FLOOD INSURANCE STUDY
TOWN OF PURCELLVILLE, LOUDOUN COUNTY, VIRGINIA

## 1.0 INTRODUCTION

### 1.1 Purpose of Study

This Flood Insurance Study investigates the existence and severity of flood hazards in the Town of Purcellville, Loudoun County, Virginia, and aids in the administration of the National Flood Insurance Act of 1968 and the Flood Disaster Protection Act of 1973. This study has developed flood risk data for various areas of the community that will be used to establish actuarial flood insurance rates and assist the community in its efforts to promote sound floodplain management. Minimum floodplain management requirements for participation in the National Flood Insurance Program (NFIP) are set forth in the Code of Federal Regulations at 44 CFR, 60.3.

In some states or communities, floodplain management criteria or regulations may exist that are more restrictive or comprehensive than the minimum Federal requirements. In such cases, the more restrictive criteria take precedence and the state (or other jurisdictional agency) will be able to explain them.

### 1.2 Authority and Acknowledgments

The sources of authority for this Flood Insurance Study are the National Flood Insurance Act of 1968 and the Flood Disaster Protection Act of 1973.

The hydrologic and hydraulic analyses for this study were performed by the Soil Conservation Service (SCS) for the Federal Emergency Management Agency (FEMA), during the preparation of the Flood Insurance Study for the unincorporated areas of Loudoun County, Virginia, and during subsequent revisions to that study. This work was completed in June 1983. Additional floodplain areas were identified by Dewberry & Davis, under contract to FEMA.

### 1.3 Coordination

The following agencies were contacted for information and data pertinent to the study: the U. S. Geological Survey (USGS), the Virginia Department of Highways and Transportation, the National Geodetic Survey, the U. S. Army Corps of Engineers (COE), the Division of State Planning and Community Affairs, and the Town of Purcellville.

On June 15, 1988, the Town of Purcellville was notified by FEMA of the initiation of a Flood Insurance Study for the town.

On October 2, 1988, a final CCO meeting was held with representatives of FEMA and the town to review the results of the study.

## 2.0 AREA STUDIED

### 2.1 Scope of Study

This Flood Insurance Study covers the incorporated area of the Town of Purcellville, Loudoun County, Virginia. The area of study is shown on the Vicinity Map (Figure 1).

South Fork Catoctin Creek was studied by detailed methods for its entire length within the community. The areas studied by detailed methods were selected with priority given to all known flood hazard areas and areas of projected development and proposed construction.

Two unnamed streams were studied by approximate methods. Approximate analyses were used to study those areas having a low development potential or minimal flood hazards.

### 2.2 Community Description

The Town of Purcellville is located in west-central Loudoun County in northern Virginia, approximately 6.5 miles west of the Town of Leesburg. The Town of Purcellville is entirely surrounded by the unincorporated areas of Loudoun County.

South Fork Catoctin Creek flows from west to east through the northern portion of the town and eventually confluences with Catoctin Creek in northern Loudoun County. South Fork Catoctin Creek is a Piedmont warm water stream in fair to poor condition, due primarily to sedimentation.

Elevations range from approximately 460 feet in the eastern portion of the town to approximately 584 feet in the central portion of the town. Temperatures average 72 degrees Fahrenheit ($^{o}$F) to 78$^{o}$F in July and 32$^{o}$F in January. The average annual rainfall is approximately 40 inches with the heaviest monthly amounts occurring in May through August.

The Town of Purcellville is bisected by State Route 7 (Main Street), and is also serviced by State Routes 287, 611, 690, and 722.

### 2.3 Principal Flood Problems

Flooding is caused mostly by local rainstorms and hurricanes. No stream flow records are available on the stream studied in detail. Large floods occurred in the area in 1937, 1942, and 1972 (Tropical Storm Agnes). Flooding has damaged roads and bridges, agricultural land and crops, homes, out buildings, and lumber yards.

### 2.4 Flood Protection Measures

No significant flood protection measures exist or have been planned at this time.

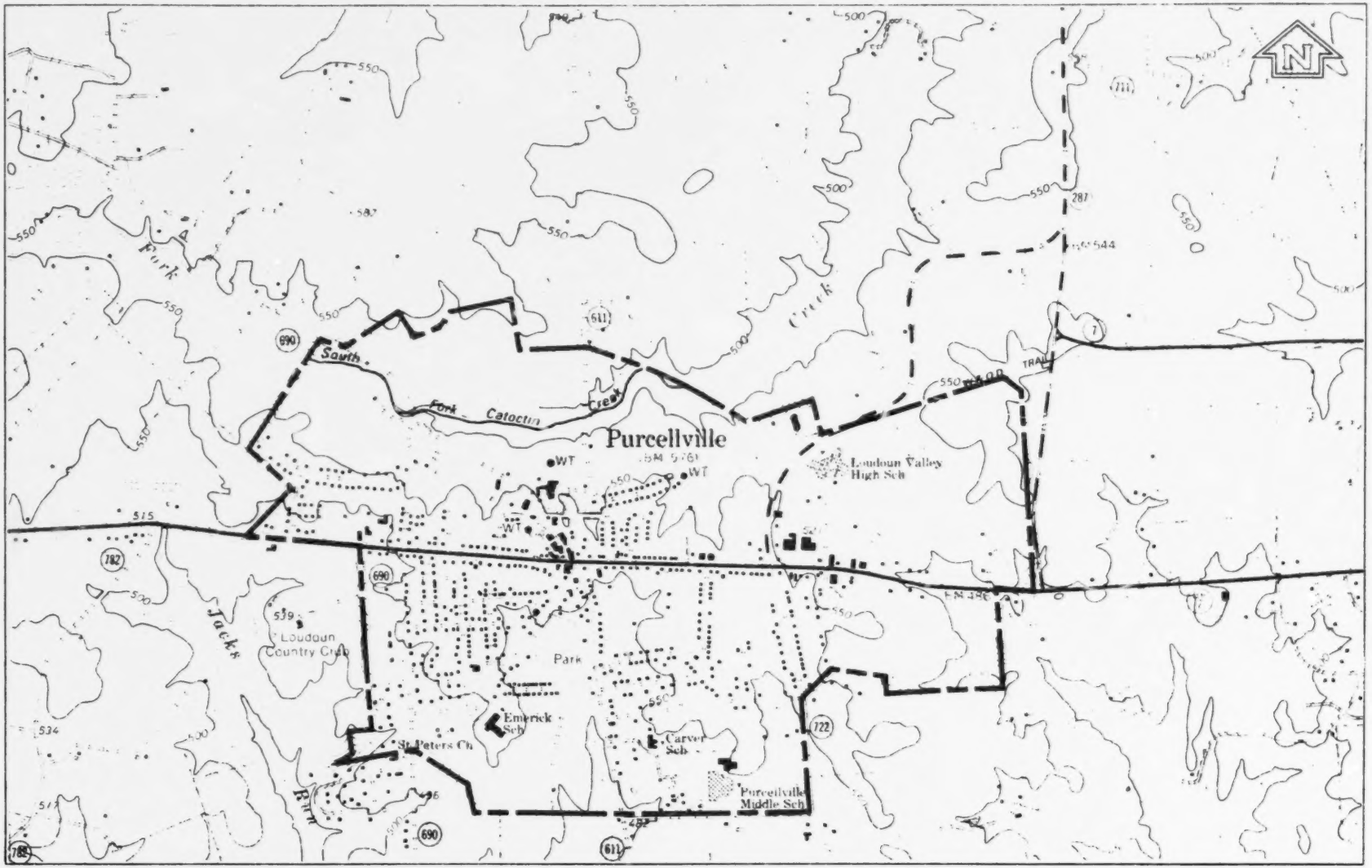



FIGURE 1

FEDERAL EMERGENCY MANAGEMENT AGENCY

**TOWN OF PURCELLVILLE, VA**

**(LOUDOUN CO.)**

APPROXIMATE SCALE

2000 0 2000 4000 6000 FEET

**VICINITY MAP**

## 3.0 ENGINEERING METHODS

For the flooding source studied in detail in the community, standard hydrologic and hydraulic study methods were used to determine the flood hazard data required for this study. Flood events of a magnitude which are expected to be equaled or exceeded once on the average during any 10-, 50-, 100-, or 500-year period (recurrence interval) have been selected as having special significance for floodplain management and for flood insurance rates. These events, commonly termed the 10-, 50-, 100-, and 500-year floods, have a 10, 2, 1, and 0.2 percent chance, respectively, of being equaled or exceeded during any year. Although the recurrence interval represents the long term average period between floods of a specific magnitude, rare floods could occur at short intervals or even within the same year. The risk of experiencing a rare flood increases when periods greater than 1 year are considered. For example, the risk of having a flood which equals or exceeds the 100-year flood (1 percent chance of annual exceedence) in any 50-year period is approximately 40 percent (4 in 10), and, for any 90-year period, the risk increases to approximately 60 percent (6 in 10). The analyses reported herein reflect flooding potentials based on conditions existing in the community at the time of completion of this study. Maps and flood elevations will be amended periodically to reflect future changes.

### 3.1 Hydrologic Analyses

Hydrologic analyses were carried out to establish the peak discharge-frequency relationships for the flooding source studied in detail affecting the community.

There are no stream gages located on South Fork Catoctin Creek in the Town of Purcellville. For this reason, synthetic hydrographs were determined for South Fork Catoctin Creek. Discharge-frequency relationships were determined using the flood routing procedures in SCS publication Technical Release No. 20 (Reference 1). The 10-, 50-, and 100-year rainfall were taken from Weather Bureau Technical Paper No. 40 (Reference 2). These were used with runoff curve numbers, times of concentration, and drainage areas in the Technical Release No. 20 computer program to calculate peak discharges for the given frequency storms.

Discharge-frequency data computed by the USGS in nearby watersheds and from Floods in Virginia - Magnitude and Frequency were used to determine regional frequency-discharge drainage area relations (References 3 and 4). These analyses were made to check discharges determined from the Technical Release No. 20 routings. The Technical Release No. 20 results were found to correlate well with the USGS results on drainage basins with similar runoff characteristics.

A summary of the drainage area-peak discharge relationships for South Fork Catoctin Creek is shown in Table 1, "Summary of Discharges."

TABLE 1 - SUMMARY OF DISCHARGES

| FLOODING SOURCE AND LOCATION | DRAINAGE AREA (sq. miles) | PEAK DISCHARGES (cfs) 10-YEAR | 50-YEAR | 100-YEAR | 500-YEAR |
|---|---|---|---|---|---|
| SOUTH FORK CATOCTIN CREEK | | | | | |
| At confluence with Catoctin Creek | 30.4 | 4,865 | 9,036 | 11,798 | 18,221 |

3.2 Hydraulic Analyses

Analyses of the hydraulic characteristics of flooding from the source studied were carried out to provide estimates of the elevations of floods of the selected recurrence intervals.

Valley cross sections were field surveyed. Additional sections were taken above and below highway crossings causing significant backwater effects. Distances between cross sections were measured from USGS quadrangle sheets along the centerline of the streams (Reference 5).

Locations of selected cross sections used in the hydraulic analyses are shown on the Flood Profiles (Exhibit 1) and the Flood Insurance Rate Map (Exhibit 2) where applicable.

Water-surface elevations for floods of the selected recurrence intervals were computed using the SCS WSP-2 computer program (Reference 6). Flood profiles were drawn showing computed water-surface elevations for floods of the selected recurrence intervals. Starting slopes were estimated for various cubic feet per second per mile (cfsm) values.

Channel roughness factors (Manning's "n") used in the hydraulic computations were assigned on the basis of field inspection of the floodplain areas. For South Fork Catoctin Creek, channel "n" values ranged from 0.040 to 0.064, and overbank "n" values ranged from 0.040 to 0.141.

The hydraulic analyses for this study were based on unobstructed flow. The flood elevations shown on the profiles are thus considered valid only if hydraulic structures remain unobstructed, operate properly, and do not fail.

All elevations are referenced to the National Geodetic Vertical Datum of 1929 (NGVD).

## 4.0 FLOODPLAIN MANAGEMENT APPLICATIONS

The NFIP encourages State and local governments to adopt sound floodplain management programs. Therefore, each Flood Insurance Study provides 100-year flood elevations and delineations of the 100- and 500-year floodplain boundaries and 100-year floodway to assist in developing floodplain management measures.

### 4.1 Floodplain Boundaries

To provide a national standard without regional discrimination, the 1 percent annual chance (100-year) flood has been adopted by FEMA as the base flood for floodplain management purposes. The 0.2 percent annual chance (500-year) flood is employed to indicate additional areas of flood risk in the community. For the stream studied in detail, the 100- and 500-year floodplain boundaries have been delineated using the flood elevations determined at each cross section. Between cross sections, the boundaries were interpolated using topographic maps at scales of 1:1,200, 1:2,400, and 1:24,000 with contour intervals of 2, 5, and 10 feet (References 7 and 5).

For streams studied by approximate methods, only the 100-year floodplain boundary has been shown. The approximate boundaries were delineated using the Town of Purcellville Water and Sewer System Master Plan map at a scale of 1:4,800 with a contour interval of 5 feet (Reference 8).

The 100- and 500-year floodplain boundaries are shown on the Flood Insurance Rate Map (Exhibit 2). On this map, the 100-year floodplain boundary corresponds to the boundary of the areas of special flood hazards (Zones A and AE), and the 500-year floodplain boundary corresponds to the boundary of areas of moderate flood hazards. In cases where the 100- and 500-year floodplain boundaries are close together, only the 100-year floodplain boundary has been shown. Small areas within the floodplain boundaries may lie above the flood elevations but cannot be shown due to limitations of the map scale and/or lack of detailed topographic data.

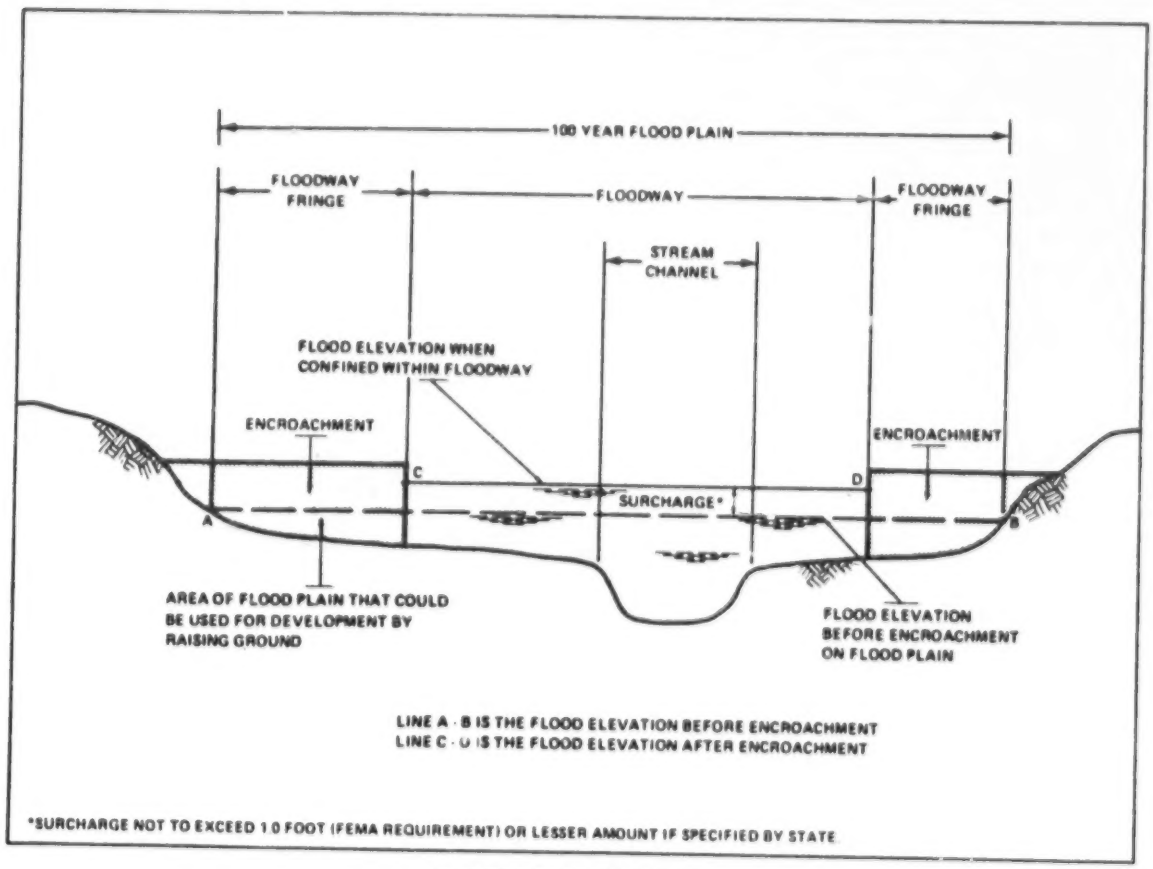
For the streams studied by approximate methods, only the 100-year floodplain boundary is shown on the Flood Insurance Rate Map (Exhibit 2).

### 4.2 Floodways

Encroachment on floodplains, such as structures and fill, reduces flood-carrying capacity, increases flood heights and velocities, and increases flood hazards in areas beyond the encroachment itself. One aspect of floodplain management involves balancing the economic gain from floodplain development against the resulting increase in flood hazard. For purposes of the National Flood Insurance Program, a floodway is used as a tool to assist local communities in this aspect of floodplain management. Under this concept, the area of

the 100-year floodplain is divided into a floodway and a floodway fringe. The floodway is the channel of a stream, plus any adjacent floodplain areas, that must be kept free of encroachment so that the 100-year flood can be carried without substantial increases in flood heights. Minimum federal standards limit such increases to 1.0 foot, provided that hazardous velocities are not produced.

The area between the floodway and 100-year floodplain boundaries is termed the floodway fringe. The floodway fringe encompasses the portion of the floodplain that could be completely obstructed without increasing the water-surface elevation of the 100-year flood by more than 1.0 foot at any point. Typical relationships between the floodway and the floodway fringe and their significance to floodplain development are shown in Figure 2.


100 YEAR FLOOD PLAIN
FLOODWAY FRINGE
FLOODWAY
FLOODWAY FRINGE
STREAM CHANNEL
FLOOD ELEVATION WHEN CONFINED WITHIN FLOODWAY
ENCROACHMENT
ENCROACHMENT
C
D
SURCHARGE*
A
B
AREA OF FLOOD PLAIN THAT COULD BE USED FOR DEVELOPMENT BY RAISING GROUND
FLOOD ELEVATION BEFORE ENCROACHMENT ON FLOOD PLAIN
LINE A - B IS THE FLOOD ELEVATION BEFORE ENCROACHMENT
LINE C - D IS THE FLOOD ELEVATION AFTER ENCROACHMENT
*SURCHARGE NOT TO EXCEED 1.0 FOOT (FEMA REQUIREMENT) OR LESSER AMOUNT IF SPECIFIED BY STATE

**FLOODWAY SCHEMATIC**

Figure 2

No floodways were calculated as part of this study.

## 5.0 INSURANCE APPLICATIONS

For flood insurance rating purposes, flood insurance zone designations are assigned to a community based on the results of the engineering analyses. The zones are as follows:

Zone A

Zone A is the flood insurance rate zone that corresponds to the 100-year floodplains that are determined in the Flood Insurance Study by approximate methods. Because detailed hydraulic analyses are not performed for such areas, no base flood elevations or depths are shown within this zone.

Zone AE

Zone AE is the flood insurance rate zone that corresponds to the 100-year floodplains that are determined in the Flood Insurance Study by detailed methods. In most instances, whole-foot base flood elevations derived from the detailed hydraulic analyses are shown at selected intervals within this zone.

Zone AH

Zone AH is the flood insurance rate zone that corresponds to the areas of 100-year shallow flooding (usually areas of ponding) where average depths are between 1 and 3 feet. Whole-foot base flood elevations derived from the detailed hydraulic analyses are shown at selected intervals within this zone.

Zone AO

Zone AO is the flood insurance rate zone that corresponds to the areas of 100-year shallow flooding (usually sheet flow on sloping terrain) where average depths are between 1 and 3 feet. Average whole-depths derived from the detailed hydraulic analyses are shown within this zone.

Zone A99

Zone A99 is the flood insurance rate zone that corresponds to areas of the 100-year floodplain that will be protected by a Federal flood protection system where construction has reached specified statutory milestones. No base flood elevations or depths are shown within this zone.

Zone V

Zone V is the flood insurance rate zone that corresponds to the 100-year coastal floodplains that have additional hazards associated with storm waves. Because approximate hydraulic analyses are performed for such areas, no base flood elevations are shown within this zone.

Zone VE

Zone VE is the flood insurance rate zone that corresponds to the 100-year coastal floodplains that have additional hazards associated with storm waves. Whole-foot base flood elevations derived from the detailed hydraulic analyses are shown at selected intervals within this zone.

Zone X

Zone X is the flood insurance rate zone that corresponds to areas outside the 500-year floodplain, areas within the 500-year floodplain, and to areas of 100-year flooding where average depths are less than 1 foot, areas of 100-year flooding where the contributing drainage area is less than 1 square mile, and areas protected from the 100-year flood by levees. No base flood elevations or depths are shown within this zone.

Zone D

Zone D is the flood insurance rate zone that corresponds to unstudied areas where flood hazards are undetermined, but possible.

## 6.0 FLOOD INSURANCE RATE MAP

The Flood Insurance Rate Map is designed for flood insurance and floodplain management applications.

For flood insurance applications, the map designates flood insurance rate zones as described in Section 5.0 and, in the 100-year floodplains that were studied by detailed methods, shows selected whole-foot base flood elevations or average depths. Insurance agents use the zones and base flood elevations in conjunction with information on structures and their contents to assign premium rates for flood insurance policies.

For floodplain management applications, the map shows by tints, screens, and symbols, the 100- and 500-year floodplains. Floodways and the locations of selected cross sections used in the hydraulic analyses and floodway computations are shown where applicable.

## 7.0 OTHER STUDIES

In June 1983, the SCS prepared a floodplain management study for Loudoun County (Reference 9). This report was used to update and extend water-surface profiles and special flood hazard zones in the revised Flood Insurance Study for the unincorporated areas of Loudoun County, and to prepare the water-surface profiles and special flood hazard zones in this study (Reference 10).

This study is not in agreement with the Flood Insurance Study for the unincorporated areas of Loudoun County (Reference 10). In that study, the profile for South Fork Catoctin Creek did not correctly identify the

corporate limits for the Town of Purcellville downstream of State Route 611. That study omitted the label, and consequently base flood elevations were incorrectly plotted. Instead of showing the correct base flood elevation at the corporate limits as 487 feet, the Loudoun County study shows it as 490 feet. This study shows the correct corporate limits and base flood elevations.

## 8.0 LOCATION OF DATA

Information concerning the pertinent data used in preparation of this study can be obtained by contacting FEMA, the Natural and Technological Hazards Division, Liberty Square Building (Second Floor), 105 South Seventh Street, Philadelphia, Pennsylvania 19106.

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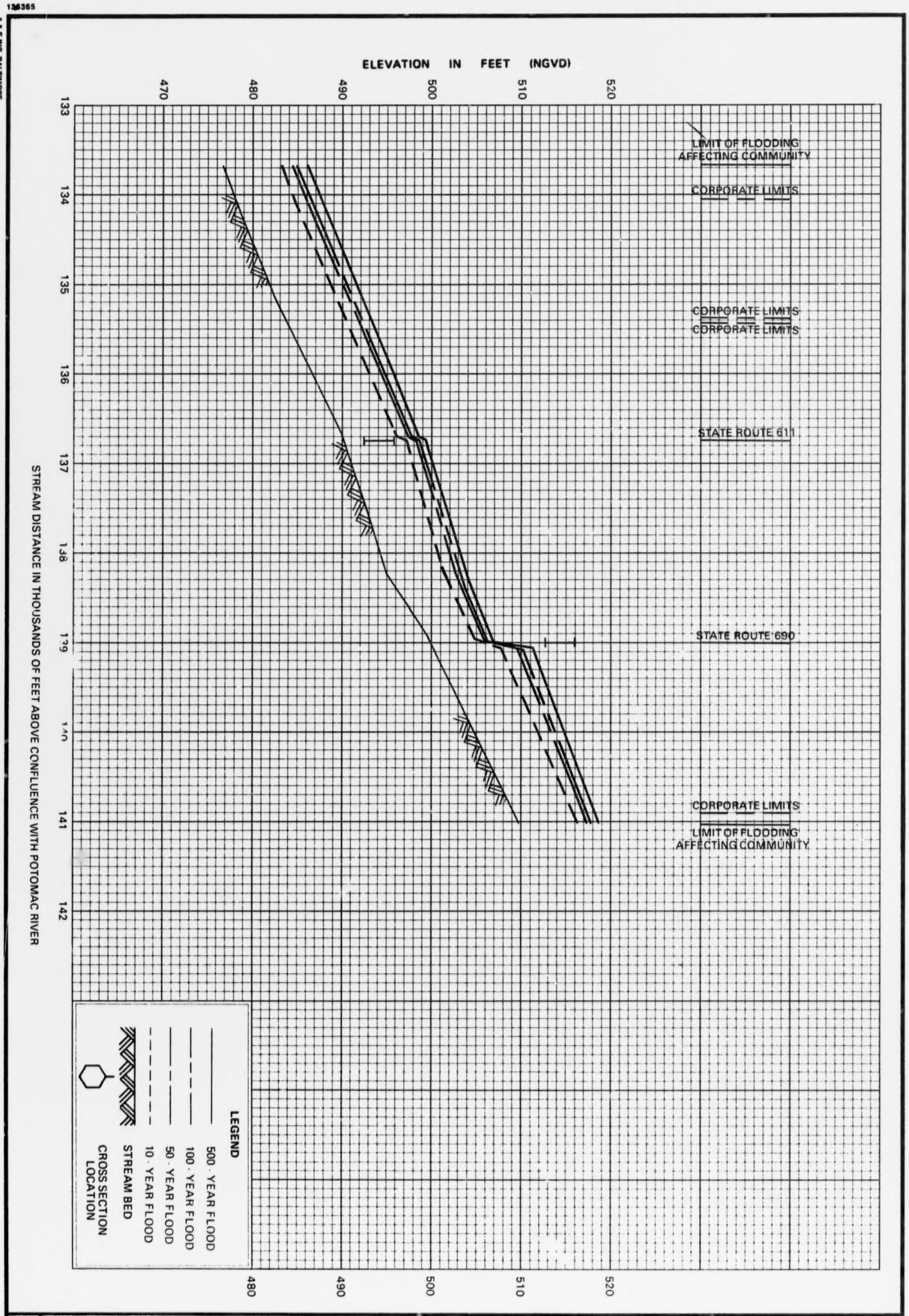


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| 01P | FEDERAL EMERGENCY MANAGEMENT AGENCY<br>**TOWN OF PURCELLVILLE, VA**<br>(LOUDOUN CO.) | **FLOOD PROFILES**<br>**SOUTH FORK CATOCTIN CREEK** |
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